3BIM Data Bases Exam (1h30)

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1 Conceptual - Relational models (5 points)

A researcher has decided to study the social organization of the research environment. He has collected a lot of data related to this topic, and he wants to organize such information using a relational database. Unfortunately, he is not an expert in data bases, and he needs some help:

A researcher is characterized by his/her name, last name, day of birth and ID number. A Researcher works for a given institution, which is characterized by its name, and its number of employees. Each institution is located in a given city. Each city is characterized by its name, the name of the country where it is located, and its zip code (which is unique for each city). We consider that it is impossible to identify fully an institution without specifying its city (e.g., the INSA institution is not fully specified, if the city where it is located is not specified). The salary of a researcher depends on the institution where he/she works. A group of researchers can work together, and present their results in a paper. A paper is characterized by its title (which is unique), its abstract and a list of keywords. Papers are published in journals, which are characterized by their names, and their impact factors. We consider that each journal name is unique. When a paper is published in a given journal, it is important to record its publication date. Finally a researcher could have been the PhD supervisor of another researcher(s), in this case, its is important to record the period during which he/she has been his/her supervisor (first and last day). Notice that a PhD student can have more that one supervisor at the same time.

- Write the entity-association model, explaining briefly the most important choices.
- Write the corresponding relational model, explaining briefly the major steps.

2 SQL (7 points)

Considering the previous exercise, write the following queries in SQL. Do not worry, the two parts are independent, I'll evaluate your queries with respect to YOUR schema, even if it is wrong:

- Create the "city" relation.
- Insert Villeurbanne in this table (city name: "Villeurbanne", country: "France", ZIP code: 69100).
- Change Villeurbanne's ZIP code to 666.
- Delete Villeurbanne from the table.
- Get the impact factor of the journal called "Nature".
- Get the name of the journal having the highest impact factor.
- Get the names of the papers published in 2019 in "Nature".
- Get the names of the authors of such papers.
- For each INSA, compute the average salary of its researchers.
- Get the city of the INSA having the highest average salary.
- Get the names of the PhD students of the researcher that has the ID 666.
- Get the names of the PhD students of the PhD students of the researcher that has the ID 666.

3 Relational Algebra (5 points)

- Write each one of the queries from Section 2, in Relational Algebra.
- If it is not possible to do so explain why.

4 Normal Forms (3 points)

- Give an example of relation that does not obey the Normal Form 1, explain why, and explain how you would proceed to turn it into NF1.
- In which cases a relation is in NF2? and in NF3?
- Explain the difference between the NF3 and the NF of Boyce-Codd.

5 No-SQL (3 points)

- What does No-SQL state for? Why using No-SQL systems?
- Give three examples of No-SQL families
- Describe the basic principles of one of these families.
- Cite one databases management system belonging to this category.